

A review of the Rhinopomatidae (Mammalia : Chiroptera)

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Synopsis

The major diagnostic features of the microchiropteran family Rhinopomatidae are reviewed, with a detailed account of the sole included genus, *Rhinopoma*. Current taxonomic opinion in the genus is synthesized with the recognition and definition of three species.

Introduction

The microchiropteran family Rhinopomatidae includes but one genus, *Rhinopoma* Geoffroy, 1818, the mouse-tailed bats, widely distributed through the arid and semi-arid regions of northern Africa and southern Asia. The genus has a long taxonomic history and displays a range of variation in cranial morphology and in size that has attracted a number of names, some even as yet of uncertain application. Although small in number of species and (Koopman & Cockrum, 1967: 117) apparently rather rare in most parts of its range, the genus nevertheless is often represented in collections, and in recent years there has been a resurgence of interest in its classification, both at the specific and subspecific levels. This review attempts to provide an interpretation of the genus as a whole, and to draw attention to its outstanding taxonomic problems.

Systematic descriptions

Family RHINOPOMATIDAE Dobson, 1872

Rhinopomatidae Dobson, 1872: 221.

Rhinopomidae Miller, 1907: 80.

Muzzle with thickened narial pad surmounted by a distinct ridge-like dermal outgrowth; tragus simple; second digit with two distinct bony phalanges; third digit with two phalanges but with no evidence of a third; tail long, mouse-like, emerging from edge of narrow uropatagium.

Skull (Fig. 1) lacking postorbital processes; lacrimal region swollen; premaxillaries separate, free, fused neither to each other nor to the adjacent parts of the skull, the narial branch well developed, the palatal branch much reduced, no more than a broadly angular thickening of the lower part of the narial branch; width of the combined nasals greater than their length; palate terminating posteriorly in the plane of the third upper molars (m^{3-3}) or just behind it; auditory bullae relatively large.

Humerus (Fig. 2) with trochiter well developed, little smaller than the trochin, reaching to the head of the humerus or slightly exceeding it, separated from humeral head by a shallow groove, trochiter with at most only a very slight articulation with the scapula (Winge, 1923 : 267; 1941 : 310); trochin well developed, very slightly exceeding humeral head; proximal face of humerus slightly ridged; a shallow supraglenoid fossa at anterior end of groove between trochiter and head; humeral head rounded; shaft of humerus with prominent deltoid crest, not displaced; capitellum very slightly displaced from line of shaft, its principal articular surface sub-spherical; lateral surface of capitellum moderate, about one third the width of the principal surface, not extending distally as far as the principal surface; trochlea narrow, about one third or a little less than the width of the principal surface, extending distally as far; epitrochlea about one third the width of the distal articular surfaces, lacking any definite epitrochlear process or spine, its distal margin forming a slight protrusion not extending distally as far as the distal edge of the trochlea; a shallow radial fossa.

Shoulder girdle without special modification; scapula normal, acromion and coracoid processes strong, the coracoid directed laterad; supraspinous fossa a little less than one half the area of the infraspinous fossa, unridged, not angled sharply from scapular spine; infraspinous fossa moderately faceted; anterior flange of scapula moderately developed. Seventh cervical vertebra not fused with first dorsal; pelvis normal, boundaries of sacral vertebrae defined; head of femur not set at an angle to the shaft; lesser trochanter similar in size to greater trochanter but slightly lower; proximal part of femoral shaft with slight flanges; ventral surface of tibia flattened and slightly grooved posteriorly; fibula complete, thread-like for much of its length.

The family contains the single genus, *Rhinopoma*, which for the most part is distributed through the arid and semi-arid parts of southern Asia and northern Africa.

Genus *RHINOPOMA* Geoffroy, 1818

Rhinopoma Oken, 1816 : 926. Not available (Opinion 417, 1956).

Rhinopoma Geoffroy, 1818 : 113. *Vespertilio microphyllus* Brünnich, 1782.

Rhinopoma Bowdich, 1821 : 30. *Vespertilio microphyllus* Brünnich, 1782.

Rhinopomus Gervais, 1854 : 202 (lapsus). *Vespertilio microphyllus* Brünnich, 1782.

Sides of muzzle swollen, the lateral swellings separated above by a broad longitudinal groove, deepening posteriorly below the inner insertion of the ears; nostrils opening anteriorly in the face of a thickened, vertical narial pad, the narial openings slit-like, in the upper part of the narial pad, oblique, inclined at about 30° to the horizontal, closed in specimens preserved in alcohol; narial pad surmounted by a thickened, ridge-like transverse dermal outgrowth; lips not swollen or wrinkled; ears large, just extending beyond muzzle when laid forward, joined at inner margins by a deep integumentary band; antitragus small, poorly defined; tragus large, membranaceous and truncate, sometimes with a small swelling in its anterior margin; long, slender tail extending from edge of reduced, rather narrow uropatagium.

Skull (Fig. 1) relatively short, rather broad; lateral swellings of rostrum sometimes extending anteriorly beyond the margins of the narial aperture; narial branches of premaxillae extending upwards at sides of narial aperture; premaxillae in contact anteriorly, enclosing an anterior palatal vacuity; maxillary toothrows slightly arched; no basioccipital pits; inner margins of auditall bullae flattened.

Dental formula $i \frac{1}{2}, c \frac{1}{1}, pm \frac{1}{2}, m \frac{3}{3} = 28$. Upper incisor (i^2) minute, styliform, oblique, barely emerging from the gum, the crown scarcely differentiated from the shaft, the tips of the upper incisors only just exceeding the premaxillae; canines (c^1) simple, lacking distinct cingula, c^1 with anterior and posterior cutting edges. Upper premolar (pm^4) with small but obvious anterior cingulum cusp; first and second upper molars (m^{1-2}) without distinct hypocones, the protoconal and hypoconal basins broadly contiguous, especially in worn teeth; third upper molar (m^3) with metacone, mesostyle and three commissures, the third commissure very short, the mesostyle displaced inwards and the metacone small, obsolescent. Lower incisors (i_{1-2}) of equal size,

touching, tricuspid, inner and outer lobes distinct, median lobe minute, sometimes obsolete, i_2 separated from c_1 by a space about equal to one half the width of i_2 ; anterior lower premolar (pm_2) long, narrow, its longitudinal diameter almost twice its transverse diameter, with relatively large cusp; second lower premolar (pm_4) wider, its width about two thirds its length; third lower molar (m_3) reduced, the posterior triangle smaller than the anterior triangle, hypoconid and entoconid low but distinct.

The genus is distributed from parts of West Africa eastward at least to India, with an outlier in Sumatra; it ranges southward in Africa to northern Kenya and northwards in the Middle East to Iran. Its classification was reviewed and discussed by Thomas (1903), Wroughton (1912 : 767), Ellerman & Morrison-Scott (1951 : 101), Rosevear (1965 : 163), Kock (1969 : 27) and DeBlase, Schlitter & Neuhauser (1973): this last study provided a brief review of the taxonomic history of the genus. Currently, three species of *Rhinopoma* are recognized: two of these, *microphyllum* and *hardwickei*, are sympatric over much of the range of the genus. The third, *muscatellum*, occurs in the southern part of Iran, and in southwestern Afghanistan; at first given specific rank by Thomas, its describer, it came later to be considered a subspecies of *R. hardwickei* but is considered now to warrant recognition as a full species by DeBlase, Schlitter & Neuhauser (1973). As a general rule, the species can be distinguished locally by their relative size but criteria of size are less satisfactory when each species as a whole is compared with the others. Kock (1969 : 27) provided an exhaustive review of the African representatives of the genus; its members in the Near and Middle East were examined by Harrison (1964 : 53) and by Gaisler, Madkour & Pelikán (1972 : 7), in Afghanistan by Gaisler (1970 : 6) while Brosset (1962 : 24) studied the two species in India.

Key to the species of *Rhinopoma*

- 1 Larger, length of forearm 57.5–75 mm, condylobasal length 17.3–20.6 mm; tail usually shorter than forearm; prominent sagittal crest; supraorbital ridges high, knife-like, their junction enclosing a recess or pocket, angled, the frontal region more or less pentagonal in outline, flat, rostrum with narial swellings not especially pronounced *microphyllum* (p. 31)
- Smaller, length of forearm 46–63.5 mm, condylobasal length 14.0–17.8 mm; tail usually longer than forearm; low sagittal crest; supraorbital ridges low, no prominent recess or pocket at their junction, straight, the frontal region more or less triangular, slightly depressed centrally; rostrum with prominent sub-globular narial swellings 2
- 2 Muzzle with well-developed transverse dermal ridge; uppermost margins of rostrum slightly divergent anteriorly; narial inflations more or less globose, not projecting laterally much beyond anteriormost point of nasals, foremost extension of swelling in profile above the rear of c^1 *hardwickei* (p. 36)
- Dermal ridge on muzzle low; uppermost margins of rostrum more nearly parallel; narial inflations slightly angular, projecting considerably beyond anteriormost point of nasals, foremost extension of swelling in profile above front of c^1 *muscatellum* (p. 40)

Rhinopoma microphyllum (Brünnich, 1782)

DISTRIBUTION. Mauritania (Poulet, 1970 : 237); Senegal (Adam & Hubert, 1972 : 62); Nigeria; Sudan; Egypt; Lebanon; Israel; Jordan; Saudi Arabia (Nader, 1975 : 334); Iran, Afghanistan; Pakistan; India; Sumatra. Earlier records of *R. microphyllum* from Mauritania and others from Morocco, Algeria and Tunisia were discussed by Kock (1969 : 41) who concluded that they referred to *R. hardwickei*. The species was reported originally from Mauritania by Dekeyser & Villiers (1952; 1956 : 44, 164, 186) and Dekeyser (1955) but the record (from Adrar) on which these reports were based is shown by Kock to be of *hardwickei*. However, Poulet (1970 : 237) records *microphyllum* and *hardwickei* sympatrically from Mauritania. The report from Morocco is based on Panouse (1951 : 38) and those from Algeria on Loche (1867 : 79); the reputed occurrence in Tunisia is doubtful (Oliver, 1909 : 148; Laurent, 1941a : 11; 1941b : 99). The genus (as *R. hardwickei*) has been reported also from Burma (Jerdon, 1867 : 29, 30) and from southern Thailand (Cantor, 1846 : 178; Jerdon, 1867 : 29, 30). Later reports (e.g. Blanford, 1891 : 362; Anderson & de Winton, 1902 : 147) evidently stem from these earlier records. Kock (1969 : 60, 62) suggested tentatively that they may refer to *R. microphyllum* but without specimens the point cannot be determined definitively.

Rhinopoma microphyllum tropicis Kock, 1969

Rhinopoma microphyllum tropicis Kock, 1969 : 58. Jebel Talao, 2 km NE of Kadugli, Kordofan, Sudan, 550 m.

This subspecies is distinguished by its greater size in some respects when compared with *R. m. microphyllum*, by its browner rather than greyer dorsal colour, brownish rather than whitish

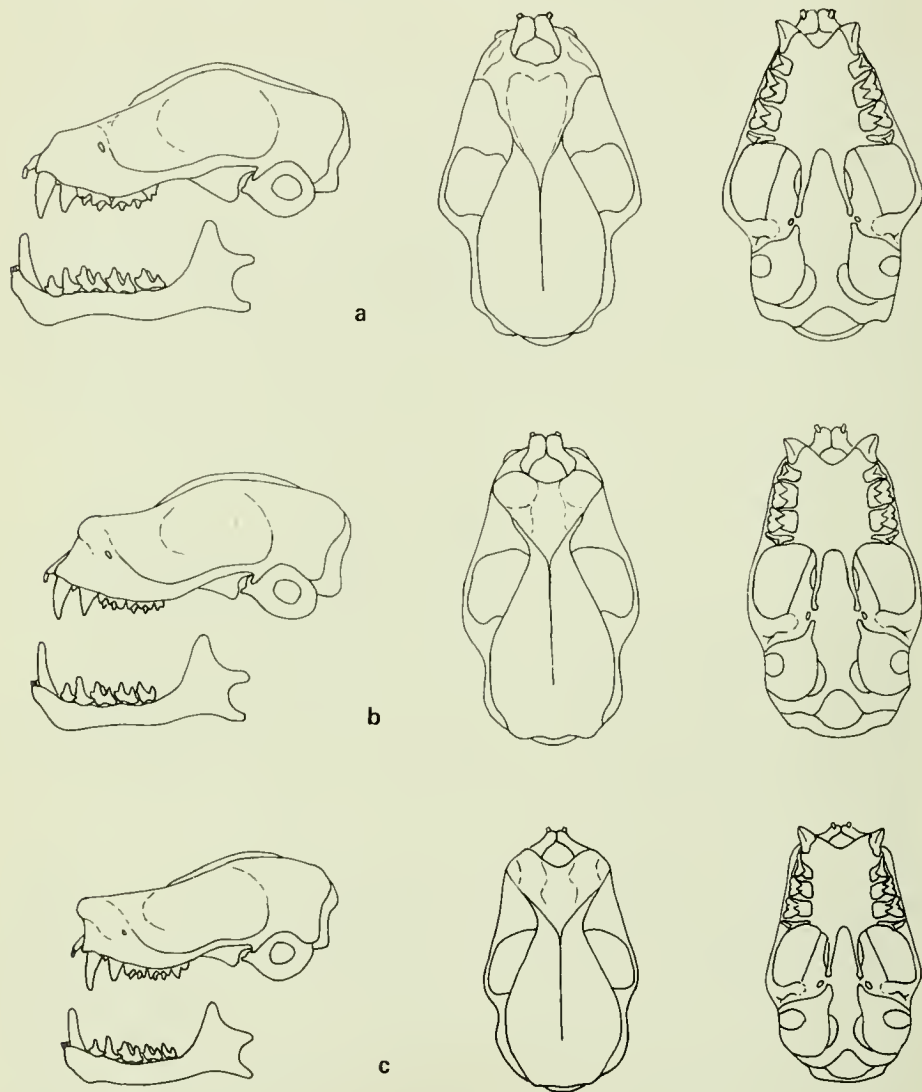


Fig. 1 Lateral, dorsal and ventral aspect of skull of (a) *Rhinopoma microphyllum microphyllum*, ♂, BM 68.485, Pakistan; (b) *Rhinopoma hardwickiei arabium*, ♂, BM 13.6.19.4, Yemen; (c) *Rhinopoma muscatellum muscatellum*, ♀, BM 85.11.5.9, Muscat.

underparts, and by its broadly U-shaped rather than V-shaped mesopterygoid fossa or palation. Kock (1969 : 60, 61, fig. 6) referred all specimens from the Sudan to this subspecies, together with the large example from Wase Rock, Nigeria, recorded by Rosevear (1965 : 166). However, specimens from Jebel Auli and from Jebel Azraq, near Khartoum, in the collections of the British Museum (Natural History), are much smaller than *tropicalis* from the Nuba Mountains (Kock, 1969 : 56, tab. 9) or the example from Wase Rock. In fact, they fall within the size range of *R. m. microphyllum* and are here referred to that subspecies; Koopman (1975 : 366) also referred these and other examples from the northern Sudan to *R. m. microphyllum* (with the comment that *tropicalis* should be restricted to Kordofan, otherwise *lepsianum* Peters, 1859 whose type-locality he restricted to Khartoum probably would have to be used for it) but suggested that this area might prove to be one of intergradation.

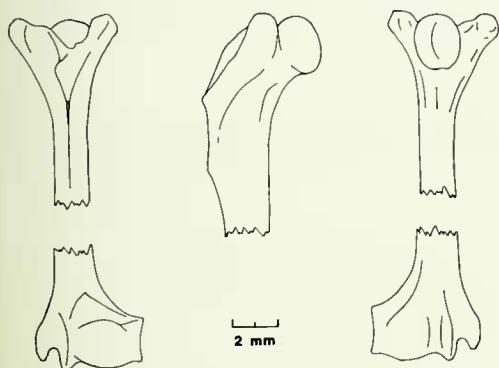


Fig. 2 Anterior, dorsal and posterior aspect of left humerus of *Rhinopoma microphyllum kinneari*, ♀ B.M. 62.919, India.

Rhinopoma microphyllum microphyllum (Brünnich, 1782)

Vespertilio microphyllus Brünnich, 1782 : 50, pl. 6, figs 1–4. Arabia and Egypt: according to Anderson & de Winton (1902 : 147) the original specimen came from the ‘Pyramids of Gizeh’. Type-locality fixed at Giza by Koopman (1975 : 366).

Rhinopoma lepsianum Peters, 1859 : 222. Blue Nile. According to Kock (1969 : 54, 57, 58) who (p. 58) designated a lectotype, from the White Nile. This author (p. 58) thought that the original material was mislabelled and actually came from Lower Egypt. Koopman (1975 : 366) restricted the type-locality to Khartoum, and suggested that the name was based on atypical material.

(?) *Rhinopoma cordofanicum* Heuglin, 1877 : 24. Araschkol Mts (= Jebel Araschkol), Sudan. According to Koopman (1975 : 367, 434), on west side of the White Nile at c. 14°15' N, 32°10' E, Blue Nile Province.

Specimens from Mauritania and Senegal seem from their published measurements (Poulet, 1970 : 241; Adam & Hubert, 1972 : 62) to be referable to the slightly smaller subspecies *R. m. microphyllum* rather than to *R. m. tropicalis*. Otherwise the nominate subspecies is distributed from Egypt and the Sudan through much of the Near and Middle East to Pakistan. Examples from Sind (listed as *kinneari* by Wroughton, 1916 : 752), together with others from Ara in the northwestern Punjab and Amb and Rohtas in the Salt Range (Sind and Salt Range specimens are measured by Siddiqi (as Siddiqui), 1970 : 4, tab. 1, and by Gaisler, 1970 : 7, tab. 1, 8, tab. 2), are referred to *R. m. microphyllum* by Gaisler (1970 : 7). Felten (1962 : 171, 172, tab. 1) refers two specimens from Rajasthan in northwestern India to *R. m. microphyllum*: the species was first reported from Rajasthan, as *R. kinneari*, by Prakash (1961 : 445) who subsequently (Prakash, 1963 : 154, 164, tab. 2) gave further details. The measurements of the specimens examined by these authors support the view that they should be referred to *R. m. kinneari*.

Kock (1969 : 35, 40, 41, 51) considered that *cordofanicum* Heuglin, 1877 represented *R. hardwickei*, treating it as a synonym of *R. h. sennaariense* (= *R. h. arabium*, q.v.). However, Thomas (1903 : 496) noted that the German authors Peters and Heuglin, who had recognized the co-existence of a larger and a smaller form in Egypt, had been misled by the early literature and had affixed their names (*lepsianum* Peters, 1859, *cordofanicum* Heuglin, 1877) to the larger

species, already named *microphyllum* by Brünnich, 1782. Kock (1969 : 40) referred *cordofanicum* to *R. hardwickei* on account of the measurements quoted by Heuglin (1877 : 24), especially of the wing span. The forearm length of the one example cited by Heuglin is given as 2 inches $5\frac{1}{2}$ lines (presumably German measure), approximately 66 mm (Kock stated 64.1 mm, the equivalent in English measure), within the range for *microphyllum*: specimens from 'Kordofan', Jebel Auli and Jebel al Azraq, all in the Sudan, in the collections of the British Museum (Natural History), range in forearm length from 62.8 to 68.8 mm. The corresponding length in *R. hardwickei* from the Sudan, from specimens in the British Museum (Natural History), is 52.8–60.4 mm. Furthermore, the collection of the British Museum (Natural History) includes an old specimen (BM 47.5.27.31, skin only), purchased of Parreys, from Arashkol. Listed by Dobson (1878 : 402), this specimen was discussed by Kock (1969 : 40) who thought that it might be a syntype of *cordofanicum*, described originally from that locality. Its forearm length of 69.7 mm, however, refers it without doubt to *R. microphyllum*, to which Koopman (1975 : 366) also allocated it. It seems likely, therefore, that *cordofanicum* represents *R. microphyllum* rather than *R. hardwickei*.

Rhinopoma microphyllum harrisoni Schlitter & DeBlase, 1974

Rhinopoma microphyllum harrisoni Schlitter & DeBlase, 1974 : 658, 10 km SE of Kazerun, Fars Province, Iran, 29°34' N, 51°46' E.

A small subspecies, its skull lacking well developed sagittal and lambdoidal crests and with the rostral ridges converging rather than parallel for part of their length, *R. m. harrisoni* ranges through southern Iran from Meshrageh southeastwards to 10 km WNW of Bustak.

Rhinopoma microphyllum kinneari Wroughton, 1912

Rhinopoma kinneari Wroughton, 1912 : 767. Bhuj, Cutch, India. Holotype in British Museum (Natural History).

Rhinopoma kinneri Garg, 1955 : 55. Lapsus.

This wholly Indian subspecies differs from *R. m. microphyllum* only in slightly larger average size as is demonstrated by Gaisler (1970 : 7, tab. 1, 8, tab. 2). This author gave detailed measurements of *R. m. microphyllum* from Iran (the specimen from Misham (= Mishen), Persian Gulf, is *R. m. harrisoni* according to Schlitter & DeBlase, 1974 : 662), Afghanistan and Pakistan with those of *R. m. kinneari* from a variety of Indian localities, the specimens other than those from Afghanistan being those of the collection of the British Museum (Natural History). The subspecies is distributed through central and western India: it has been reported from Rajasthan (Prakash, 1961 : 445; 1963 : 154; Felten, 1962 : 171, as *R. m. microphyllum*), Bombay, Delhi, Madhya Pradesh and Uttar Pradesh.

Ellerman & Morrison-Scott (1951 : 102) considered *kinneari* specifically distinct but subsequent authors (Aellen, 1959 : 357; Felten, 1962 : 171) have regarded it as only subspecifically separable from *microphyllum* while Siddiqui (1961 : 106; 1970 : 4 (the latter as Siddiqui)) synonymized it with *microphyllum*. Kock (1969 : 60) thought that *kinneari* might be a possible synonym either of *microphyllum* or of *sumatrae*.

Rhinopoma microphyllum sumatrae Thomas, 1903

Rhinopoma sumatrae Thomas, 1903 : 497. Balighe, near Lake Toba, north Sumatra. Holotype in British Museum (Natural History).

Few specimens of this subspecies are known and these differ but little from *kinneari*; Thomas diagnosed it on grounds of great size but their dimensions in fact fall within the range of those of the Indian subspecies. The remark by its describer that *sumatrae* differs from the Indian *R. hardwickei* not only in size but in the non-inflation of its nasal prominences confirms its allocation to *R. microphyllum*, and Kock (1969 : 59, 60) considered that *kinneari* might be a possible synonym of *sumatrae*. To synonymize these at present introduces a widely discontinuous distribution since *sumatrae* has been reported only from the type-locality; it should be noted that it is the prior name.

Table 1 Measurements (in millimetres) of *Rhinopoma microphyllum*.

	Length of forearm		Condylobasal length		Condylocanine length		Zygomatic width		Mastoid width		c-m ⁸		
	n	R	n	R	n	R	n	R	n	R	n	R	
<i>R. m. tropicalis</i>													
Nigeria ¹	1	74.9	1	20.6	1	20.0	1	13.5	1	10.9	1	7.7	
Sudan (Nuba Mts) ²	6	70.2-74.0	6	19.4-20.1				6	12.6-13.1			6	7.2-7.5
<i>R. m. microphyllum</i>													
Mauritania ³		61-68											
Senegal ¹	1	66	1	20.2									
Sudan (Khartoum) ¹ *	5	62.8-68.8	1	18.1	2	17.6-18.1	1	11.5			1	7.2	
Sudan (Arashkol) ¹	1	69.7					2	11.8	2	9.5-9.7	2	6.8-7.2	
Egypt ¹	4	59.9-69.3	2	18.0-18.8	2	17.7-18.5	1	11.8	2	9.7-9.9	2	7.2-7.4	
Lebanon, Israel ⁶	3	68.2-71.7	2	19.6-20.2			1	12.7-12.8			2	8.2	
Jordan ¹	1	64.2	1	19.1	1	18.6			1	9.6	1	7.2	
Saudi Arabia ⁶	1	69	1	19.5			1	12.3			1	7.2	
Iran ^{1, 7}	12	65.3-70.1	11	18.8-20.0	1	18.4	13	12.0-13.1	1	9.9	13	6.7-7.6	
Afghanistan ^{8, 9}	93	62.0-70.5	77	18.0-20.1	2	18.7-19.3	85	11.1-12.8	79	9.2-10.2	91	7.0-7.8	
Pakistan ¹	17	62.9-71.5	11	17.6-19.2	14	17.2-19.0	9	11.4-12.4	13	9.3-10.3	16	6.8-7.3	
<i>R. m. harrisoni</i>													
S. Iran ^{1, 8}	26	57.5-66.1	27	17.3-19.5	1	18.5	27	10.8-12.4			10	6.4-7.3	
<i>R. m. kimeari</i>													
India ¹													
Rajasthan, India ¹⁰	12	66.0-73.6	12	19.5-20.5	12	18.8-19.9	11	12.2-13.4	12	10.4-11.1	12	7.3-7.9	
Rajasthan, India ¹¹	2	70					2	12.5			2	7.3-7.6	
	84	64.5-75.0	12	20.0-21.2			12	12.0-13.5					
<i>R. m. sumatrae</i>													
Sumatra ¹	2	68.8-70.6	2	19.4-20.0	2	18.9-19.7	2	12.5-12.7	2	10.2-10.4	2	7.5-7.8	

n = number of specimens; R = range.

* The type-locality of *leptistanum* Peters, 1859 is restricted to Khartoum by Koopman (1975: 366). A lectotype and paratype from 'White Nile' designated by Kock (1969: 58) measure (p. 56, tab. 9): length of forearm (1) 68.9, condylobasal length (2) 19.0-19.7, zygomatic width (2) 13.1, mastoid width (2) 10.0-10.7, c-m⁸ 6.8-7.2. ¹ British Museum (Natural History); ² Kock, 1969: 56, tab. 9; ³ Poulet, 1970: 241; ⁴ Adam & Hubert, 1972: 62; ⁵ Harrison, 1964: 55, tabs 25, 26; ⁶ Nader, 1963: 164, tab. 2. ⁷ Schlitter & DeBlase, 1974: 660, tab. 1; ⁸ Aellen, 1959: 338, 359; ⁹ Gaisler, 1970: 7, tab. 1, 8, tab. 2; ¹⁰ Felten, 1962: 172, tab. 1; ¹¹ Prakash,

Rhinopoma hardwickei Gray, 1831

DISTRIBUTION. Niger; Mauritania; Morocco; Algeria; Tunisia; Egypt; Sudan; northwestern Kenya; Ethiopia; French Somaliland (Territory Afars & Issas); Somalia; Socotra I.; Israel; Jordan; Saudi Arabia; Aden; Yemen; South Yemen; Muscat and Oman; Iraq; Iran; Afghanistan; Pakistan; India; reported from Burma (Jerdon, 1867 : 29, 30) and from southern Thailand (Cantor, 1846 : 178) but this latter record listed as *R. microphyllum* by Kloss (1908 : 155). It is not clear whether these reports from Burma and Thailand refer to *R. hardwickei* or to *R. microphyllum*; Kock (1969 : 62) tentatively allocates the records that stem from them (i.e. Blanford, 1891 : 253; Anderson & de Winton, 1902 : 147; Chasen, 1940 : 31; Ellerman & Morrison-Scott, 1951 : 102) to *microphyllum*.

There is a widespread local size variation in *R. hardwickei* leading to the recognition of a number of subspecies; until recently it has been customary for authors to refer the greater part of the African population to *R. h. cystops* Thomas, 1903, on occasion including with it the population in the Near East sometimes referred to *R. h. arabium* Thomas, 1913. A small subspecies, *R. h. macinnesi* Hayman, 1937 has been recognized in northern Kenya and the southern Sudan although Hayman & Hill (1971 : 14) thought it a probable synonym of *cystops*; further small forms, *R. h. muscatellum* Thomas, 1903, *R. h. seianum* Thomas, 1913 and *R. h. pusillum* Thomas, 1920 have been reported from Oman and southern Iran, while the nominate subspecies has been restricted to Afghanistan, Pakistan and India. The species was reviewed in considerable detail by Kock (1969) who recognized six subspecies.

DeBlase, Schlitter & Neuhauser (1973), however, have raised *muscatellum*, with synonym *pusillum* and valid subspecies *seianum* to the rank of a full species, and Kock (1969) and Gaisler, Madkour & Pelikán (1972) have suggested that the pattern of subspeciation may be more complicated than originally thought. Kock (1969 : 35, 42, map, 51), in a detailed review, recognized a smaller, central Saharan subspecies, *R. h. cystops*, extending from Hoggar in Algeria and Air in Niger to central Egypt, surrounded by a larger subspecies, *R. h. sennaariense* Fitzinger, 1866, which extends also into the Near East and Arabia, with a smaller subspecies, *R. h. macinnesi*, extending from the southeastern Sudan and northern Kenya to Somalia and to Assab in Eritrea, Ethiopia. This author considered the Arabian form *R. h. arabium* a synonym of *R. h. sennaariense* and allocated eastern Arabian and Iranian specimens to *R. h. muscatellum* (including *pusillum*) and *R. h. seianum*, with the nominate subspecies in Afghanistan, Pakistan and India. Koopman (1975 : 367) agreed with Kock for the African representatives of the species, but pointed out that *sennaariense* is a nomen nudum and in its place used *cordofanicum* Heuglin, 1877. This author also recorded four specimens from French Somaliland (Territory Afars & Issas) which agree well with the larger of the African subspecies rather than with the smaller *R. h. macinnesi*.

In a study of the Egyptian population, Gaisler, Madkour & Pelikán (1972 : 7) adopted the views of Kock for the African and Near East populations but from an examination (p. 8, fig. 1) of the condylobasal length and toothrow length of specimens from these areas gave an indication of the variability of the two parameters. They concluded that this analysis confirmed that the specimens from the Upper Egyptian population are smaller in these respects than those from the population in Lower Egypt; that specimens from the Near East have a relatively short upper toothrow, with the lowest values in the Yemen; and that the Sudanese population is intermediate between those from Lower Egypt and the Near East. These authors suggested that the analysis indicated that the matter can be resolved in various ways: (1) by recognizing but a single subspecies; (2) by separating the Upper Egyptian population and classifying those remaining as a single subspecies; or (3) by recognizing the Sudanese population, the Upper Egyptian population and the Arabian population as distinct subspecies, and describing the population in Lower Egypt as new. It is clear from the data assembled by Gaisler, Madkour & Pelikán that the variation is largely clinal, but erratic; the variations in size may reflect the vagaries of climate as is suggested by Kock (1969 : 48, 50, tab. 8).

The view adopted here is that of Kock (1969); *cystops* is retained for a smaller, Saharan subspecies, surrounded in Africa by a slightly larger form which Kock calls *sennaariense*, with a yet smaller form, *macinnesi*, in the southeastern Sudan, northeastern Kenya and perhaps in Somalia and eastern Ethiopia. Specimens from Israel, Jordan, Arabia and from the remainder of the

Near and Middle East are referred to the larger of the African forms, while those from Afghanistan, Pakistan and India are considered to represent the nominate subspecies and are yet rather larger. The small size variations noted by Gaisler, Madkour & Pelikán seem scarcely to justify further subspecific recognition, and, indeed, may become less significant when collections become more representative.

Rhinopoma hardwickei cystops Thomas, 1903

Rhinopoma cystops Thomas, 1903 : 496. Luxor, Egypt. Holotype in British Museum (Natural History).

Kock (1969 : 52) referred specimens from Algeria (Hoggar), Niger (Air) and from central and Upper Egypt to *R. h. cystops*. These average a little smaller than other populations of *R. hardwickei* from northern Africa.

Rhinopoma hardwickei arabium Thomas, 1913

Rhinopoma sennaariense Fitzinger, 1866 : 547. Sennaar and Fazuglo (= Fazughli), near Roseires, Sudan.

Type-locality restricted to Fazughli by Kock (1969 : 35). Nomen nudum.

Rhinopoma longicaudatum Fitzinger, 1866 : 547. Sennaar, Sudan. Nomen nudum.

Rhinopoma senaarensense, potius *senarensense* Heuglin, 1877 : 24. Emendation of *sennaariense* Fitzinger, 1866.

Rhinopoma cystops arabium Thomas, 1913 : 89. Wasil, Yemen, 4000 ft [1200 m]. Holotype in British Museum (Natural History).

Rhinopoma arabicum K[innear], 1916 : 3. Mesopotamia (= Iraq). Lapsus.

Vespertilio ferox Stresemann, 1954 : 172. Sackhara (= Saqqara), Egypt. Label name ex Hemprich, without nomenclatorial status.

Vespertilio brevicauda Stresemann, 1954 : 172. Sackhara (= Saqqara), Egypt. Label name ex Hemprich, without nomenclatorial status.

Rhinopoma lardwickei cystops Madkour, 1961 : 50. Lapsus.

Rhinopoma hardwickei sennaariense Kock, 1969 : 40, 51. Fazogli (= Fazughli), Blue Nile, Sudan. Validation ex Fitzinger, 1866, nomen nudum.

Rhinopoma senaariense Koopman, 1975 : 367. Lapsus.

This subspecies, very slightly larger on the average than *R. h. cystops*, is distributed through Mauritania, Morocco, Algeria, Tunisia, Niger, Sudan, Lower Egypt, Ethiopia and French Somaliland (Territory Afars & Issas); it extends to the island of Socotra and to Israel, Jordan and Arabia, eastward to Iran.

Kock (1969 : 40, 51) employed *sennaariense* Fitzinger, 1866, for this subspecies but the account by Fitzinger (1866 : 547) provides no descriptive information at all, consisting merely of the name and locality. Neither is the name validated by Heuglin (1877 : 24), who emended it but provided no descriptive material. According to Gaisler, Madkour & Pelikán (1972 : 7), the discovery of the type-specimen in the Vienna Museum by Kock supports the validity of the name but in fact this discovery has no bearing on its nomenclatorial status. The first use of *sennaariense* with any descriptive data appears to be that of Kock (1969); in these circumstances the first available name, *arabium* Thomas, 1913, is used for the subspecies. Koopman (1975 : 367) pointed out that *sennaariense* Fitzinger, 1866 is a nomen nudum and used *cordofanicum* Heuglin, 1877 for the larger of the African subspecies. But this name (see above, p. 33) is likely to be a synonym of *R. microphyllum*.

Rhinopoma hardwickei macinnesi Hayman, 1937

Rhinopoma cystops macinnesi Hayman, 1937 : 530. Bat Island, near Central Island, Lake Rudolf, Kenya.

Holotype in British Museum (Natural History).

A very small subspecies, reported from the southeastern Sudan by Kock (1969 : 42, fig. 5, 52) and by Koopman (1975 : 368) and from Ethiopia (Assab, Eritrea) and Somalia (Bender Cassim) by the former author (1969 : 42, fig. 5, 52), but originally described from Lake Rudolf in north-eastern Kenya and in that country reported from Lake Baringo by Kock (1969 : 42, fig. 5, 45, tab. 6, 52). Elsewhere, Kock (1969 : 50, tab. 8) lists Sudanese and Kenyan specimens as *macinnesi* but those from Assab, Eritrea and Bender Cassim, Somalia, as *cystops*. Largen, Kock & Yalden

Table 2 Measurements (in millimetres) of *Rhinopoma hardwicki*.

	Length of forearm		Condylobasal length		Condylocanine length		Zygomatic width		Mastoid width		c-m ³	
	n	R	n	R	n	R	n	R	n	R	n	R
<i>R. h. cystops</i>												
Niger (Air) ^{1, 2}	2	52-55.5	1	15.6	1	15.0	1	9.4	1	8.5	2	5.2-5.3
Algeria ²											1	6.0
Central and Upper Egypt ^{1, 3, 4}	55	46.2-57.0	31	14.9-16.2	3	14.9-15.0	32	9.5-10.2	25	8.0-8.9	32	5.4-6.0
<i>R. h. arabium</i>												
Niger (Zinder) ²	15	54-61.5	8	16.2-16.7			8	9.8-10.3			8	5.7-6.1
Mauritania ³		52-58										
Morocco ²	? 1	59										
Tunisia ²	? 1	56	? 1	16.7			? 1	10.3			? 1	6.3
Lower Egypt ^{1, 3, 4}	69	50.3-62.0	46	15.3-16.9	1	15.5	42	9.6-11.0	38	8.3-9.3	51	5.6-6.5
Sudan ^{1, 4, 6}	116	52.0-62.1	30	15.0-17.1	47	14.4-16.5	26	9.6-11.8	3	8.2-8.7	82	5.0-6.1
Ethiopia ¹	14	52.9-56.6	7	15.0-15.7	7	14.4-15.4	3	9.4-9.9	7	8.0-8.9	7	5.5-5.7
French Somaliland	4	56-59			3	15.2-16.0						
Socotra I. ^{1, 7}	55	51.5-61.5	15	15.5-16.8			16	9.8-10.6			17	6.0-6.4
Israel ⁸	31	50.6-59.3	29	15.5-17.2			23	9.6-10.6			29	5.3-6.1
Jordan ^{1, 8}	5	54.8-57.3	5	15.8-16.6	3	15.5-16.1	5	10.0-10.3	3	8.6-8.9	5	5.7-6.6
Saudi Arabia ¹	17	52.1-57.8	5	15.4-15.3	7	15.2-16.0	4	9.8-10.3	7	8.3-9.2	5	5.6-6.0
Aden; Sira I.; Jazirat-el-Abid (Slave I.) ^{1, 9}	17	49.3-57.9	5	15.2-16.1	3	15.0-15.8	5	8.8-15.8	3	8.4-8.7	7	5.2-5.9
Yemen ¹	8	53.5-57.5	7	15.0-16.4	7	14.9-16.3	8	9.7-10.2	10	8.5-9.6	7	5.6-6.0
Iran ¹⁰	12	52.4-60.0	6	15.6-16.9			5	9.6-10.9			9	5.7-6.3
<i>R. h. macinnesi</i>												
Kenya ¹	12	45.6-50.6	2	14.0-14.1	2	13.7	2	8.4-8.6	2	7.8	2	5.1
SE Sudan ^{8, 7}	2	48-48.4	1	15.5	1	14.6	1	9.6			2	5.6
Ethiopia (Assab) ^{7, *}	? 1	47.2	? 1	14.6			? 1	9.2			? 1	5.6
Somalia (Carim) ^{7, †}	? 1	50.5	? 1	14.1			? 1	9.9			? 1	6.0
Somalia (Carim) ^{11, †}	2	50-51			2	14.7-15.0						

(Table 2 cont.)

*R. h. hardwicki*Afghanistan¹²Pakistan¹India¹

17	56.0-63.5	17	16.2-17.4	17	10.0-11.1	17	8.3-9.4	17	6.0-6.4
10	57.7-63.1	8	15.9-17.5	10	15.5-17.0	6	10.0-10.7	10	8.6-9.4
40	53.3-62.7	19	16.3-17.8	30	15.7-17.5	23	10.3-11.6	30	8.7-9.8

n = number of specimens; R = range.

* Referred to *R. muscatellum* by Largent, Kock & Yalden, 1974 : 230.

† Probably based on same material.

¹ British Museum (Natural History); ² Kock, 1969 : 39, tab. 5; ³ Kock, 1969 : 38, tab. 4; ⁴ Gaisler, Madkour & Pejikán, 1972 : 9, tab. 3, 10, tab. 4; ⁵ Poulet, 1970 : 241; ⁶ Koopman, 1975 : 367; ⁷ Kock, 1969 : 45, tab. 6; ⁸ Harrison, 1964 : 57, tab. 27, 59, tab. 28; ⁹ Harrison, 1964 : 58, tab. 27, 60, tab. 28; ¹⁰ DeBlase, Schlitter & Neuhauser, 1973 : 837, tab. 2; ¹¹ Koopman, 1975 : 368; ¹² Gaisler, 1970 : 9, tab. 3, 10, tab. 4.

Table 3 Measurements (in millimetres) of *Rhinopoma muscatellum*.

	Length of forearm		Condylbasal length		Condylocanine length		Zygomatic width		Mastoid width		c-m ³	
	n	R	n	R	n	R	n	R	n	R		
<i>R. m. muscatellum</i> Oman; Iran ^{1, 2}	27	45.0-52.4	12	14.2-15.5	5	13.7-14.6	12	8.9-9.5	4	8.0-8.2	14	5.2-6.1
<i>R. m. seianum</i> E Iran; Afghanistan ^{1, 3, 4}	13	51.5-54.8	12	15.0-16.2	4	14.8-15.5	11	9.4-10.1	4	8.0-8.4	4	5.8-6.1

n = number of specimens; R = range.

¹ British Museum (Natural History);² DeBlase, Schlitter & Neuhauser, 1973 : 837, tab. 2; ³ Zimmerman,1956 : 196; ⁴ Aellen, 1959 : 356, 357.

(1974 : 230) refer the two very small specimens from Assab (first reported by Senna, 1905 : 292, later referred to *macinnesi* by Kock, 1969 : 42, fig. 5, 52, or listed as *cystops* by the same author, 1969 : 50, tab. 8) to *muscatellum* but did not examine them. They say, 'Senna's (1905) specimens have not been re-examined but are presumed to belong here'. According to Koopman (1975 : 368), specimens from Carim, Somalia (two females, in the Museo Civico di Storia Naturale 'Giacomo Doria', Genoa), are larger than *macinnesi*, with length of forearm 50–51 mm and condylocanine length 14.7–15.0 mm. This author also recorded four specimens from Ali Sabiet, French Somaliland (Territory Afars & Issas), with length of forearm 56–59 mm, condylocanine length in one male 16.0 mm, in two females 15.2–15.5 mm. These agree more nearly with *R. h. arabium*. Comparative measurements given by Kock (1969 : 45, tab. 6) include one of the specimens from Assab.

Rhinopoma hardwickei hardwickei Gray, 1831

Rhinopoma hardwickei Gray, 1831 : 37. India. Holotype in British Museum (Natural History).

The largest of the subspecies of *R. hardwickei*, the nominate subspecies occurs in eastern Afghanistan, in Pakistan and in India. Records of *Rhinopoma* from Burma and from southern Thailand are problematical, as already noted (pp. 31, 36). This subspecies has been reported as far north as the environs of Jalalabad in Afghanistan, in the Salt Range in the north of Pakistan and in India as far east as Bihar. It has not been reported from Sri Lanka, but in India specimens have been obtained as far south as the Palni Hills, Madras, 10°14' N, 77°33'E.

Rhinopoma muscatellum Thomas, 1903

DISTRIBUTION. Oman; southwestern, southern and eastern Iran; southern Afghanistan; (?) Ethiopia (Eritrea).

For many years *R. muscatellum* Thomas, 1903, *R. muscatellum seianum* Thomas, 1913 and *R. pusillum* Thomas, 1920 were considered to be subspecies of *R. hardwickei*. However, DeBlase, Schlitter & Neuhauser (1973) have demonstrated that these small forms of *Rhinopoma* differ in one external and four cranial features from *hardwickei*, and, furthermore, that *muscatellum* and *hardwickei* occur sympatrically in southern Iran.

Rhinopoma muscatellum differs from *R. hardwickei* in the shape of the superior transverse dermal ridge surmounting the narial pad; in *R. hardwickei* this ridge is quite well developed and may be evenly rounded or have a small medial dorsal papilla but in *muscatellum* the noseleaf is at most poorly developed and consists only of a low ridge that may be flat above or may have a slight medial depression. Cranial differences on the whole are more definite; in *muscatellum* the upper parts of the rostrum are not greatly divergent; the narial inflations are relatively larger and slightly angular, projecting considerably beyond the anteriormost point of the nasals, with their foremost extension lying above the front of the canine (c^1); the palation is generally V-shaped and as a rule terminates beyond the plane of the last molars (m^{3-3}); the post-palatal projection is narrower (least breadth 1.6–2.2 mm as against 2.2–2.7 mm in *hardwickei*); and although there is some overlap in size, *muscatellum* is generally smaller than the Asiatic subspecies of *hardwickei*. In this latter species the uppermost margins of the rostrum tend to be divergent; the narial inflations are globose and do not extend anteriorly to any great extent, not extending greatly beyond the anteriormost point of the nasals and with their anteriormost point lying above the rear of c^1 ; the palation is generally U-shaped and as a rule terminates in the plane of the last molars, and the post-palatal extension is wider even in the very small subspecies *macinnesi* from the Sudan and Kenya.

Rhinopoma muscatellum muscatellum Thomas, 1903

Rhinopoma muscatellum Thomas, 1903 : 498. Wadi Bani Ruha, Muscat, Oman. Holotype in British Museum (Natural History).

Rhinopoma pusillum Thomas, 1920 : 25. Sib, southeastern Iran. Holotype in British Museum (Natural History).

The subspecies ranges from Oman and southwestern Iran eastwards almost to the Iran–Pakistan border, in Baluchistan. Lagen, Kock & Yalden (1974 : 230) refer two small specimens of *Rhino-*

poma from Assab, Eritrea, Ethiopia to *R. muscatellum*, without direct examination. These hitherto have been allocated to *R. hardwickei* and are discussed under that species (p. 37); if correctly they represent *R. muscatellum* they are the first of the species to be reported from Africa.

Lay (1967: 133) concluded from an examination of a series of specimens that *pusillum* Thomas, 1920, originally distinguished from *seianum* Thomas, 1913 on the grounds of small size, much smaller teeth and shorter tail, fitted into the range of size variation observed among topotypical material of *seianum* with which he compared it, and consequently synonymized *pusillum* with *R. hardwickei seianum* (= *R. muscatellum seianum*). However, DeBlase, Schlitter & Neuhauser (1973: 838) refer specimens from southeastern Iran, including *pusillum*, to *R. muscatellum muscatellum*.

Rhinopoma muscatellum seianum Thomas, 1913

Rhinopoma muscatellum seianum Thomas, 1913: 90. Seistan, Iran. Holotype in British Museum (Natural History).

Distinguished from *R. m. muscatellum* by generally larger size and proportionately smaller bullae, and reported from eastern Iran, near the border with Afghanistan, and from southern Afghanistan.

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